The bending rigidity of lipid bilayers in the anomalous swelling regime determined by neutron spin echo(Poster session 2, New Frontiers in Colloidal Physics : A Bridge between Micro- and Macroscopic Concepts in Soft Matter)

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人工リン脂質が水中で形成するラメラ構造は、リン脂質分子の膜内でのpackingの違いにより、温度上昇に応じてゲル相から液晶相に転移する。そしてDMPCやDPPCなどのリン脂質においては、ゲル相/液晶相の転移点直上において膜間距離が増大する「異常膨潤」の現象が見られることが知られていた。今回はその異常膨潤の要因を調べるため、中性子スピンエコー法を用いて二重膜の曲げ弾性係数の変化を調べた。その結果、膜間距離が広がるに従って膜が堅くなる事が分かった。これは、膜が柔らかくなることにより立体斥力が増大して膜間距離が広がる、と言うこれまで考えられていた描像に反する結果となっている。

The origin of anomalous swelling in multilamellar vesicles of phospholipids upon approaching the main transition [1] is still a matter of dispute. From the recent small-angle X-ray scattering experiment on DMPC, the decrease of the bending modulus of the lipid bilayers is confirmed to be the origin of the anomalous swelling; this would increase undulations of lipid bilayers and would increase the steric repulsion between bilayers. [2] However, nobody has any ideas to explain the microscopic origin of the decrease of bending modulus near the main transition so far.

Neutron spin echo is the most effective tool to estimate the bending modulus of lipid bilayers, because a dynamics of bilayers could be observed. Thus, we have compared the dynamics of lipid bilayers in the anomalous swelling regime with that in the normal liquid crystalline phase. The result showed that the bending modulus increases in the anomalous swelling regime. This tendency is opposite with the previous results in the literature. On the other hand, it is the same as observed in a "swollen phase" induced by adding ethanol and/or applying pressure. [3]

References

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